REMARKS

Status of Claims

Claims 1 – 36 were original in the application. Claims 37 - 45 were previously added. Claims 2 – 10, 14 – 24, 26, 32, 41, 42 and 44 have been previously cancelled. The amendments of the preceding Amendment After Final filed on Oct. 4, 2006 are assumed to be entered prior to the amendments here as provided in MPEP 706.07(h)(III)(D). Claims 1, 11, 27, 28, 31, 34, 37, and 38 are currently amended. Claims 29 and 35 are cancelled. Claims 1, 11 - 13, 25, 27, 28, 30 - 31, 33 – 34, 36 - 40, 43 and 45 are submitted as being set forth for substantive examination.

Rejection Pursuant to 35 USC 112

Claim 1 has been responsively amended to include the step of cryomilling MCrAlY without the inclusion of other metallic alloys to produce substantially nanocrystalline MCrAlY, where M is comprised of at least one of the group of Co, Ni and Fe; and to include the step of thermally spraying the nanocrystalline MCrAlY onto a metallic substrate. Since nanocrystalline MCrAlY is sprayed, the step of cryomilling MCrAlY to produce the substantially nanocrystalline MCrAlY clearly must occur prior to the step of spraying.

Claims 37 – 40 and 43 are rejected under section 112, first paragraph, for claiming a "fully nanocrystalline MCrAlY" layer. The Applicants believe based on the Interview that the Examiner is "amenable" to withdrawing the 112 rejection of Claims 37, 43 by removing "fully" from "fully nanocrystalline".

Claim Rejections - 35 USC § 102

Claims 1, 13, 25, 27, 31, 33 and 37 were rejected as being anticipated by Hebsur US Patent 6,805,725.

The Applicants believe based on the Interview discussion that the Examiner is amenable to withdrawing the sec. 102 rejection of independent Claims 1, 13, 25, 31, 37, 43 by inclusion of the phrasing "without inclusion of other metallic alloys" in the claims. This limitation has been included by the entered Amendment After Final into each of these claims.

The Examiner admits that Hebsur '725 discloses a NiAl and CoCrAlY system, which is mostly NiAl and in fact is 85% by volume composed of NiAl. (Col. 2, lines 38 – 40). Each of the rejected claims is limited to bond coat composed substantially of nanocrystalline MCrAlY without inclusion of other metallic alloys. The claim does not read on Hebsur '725 and therefore is not anticipated by it.

Rejection Pursuant to 35 USC 103(a)

Claims 11, 12, 28, 34, 38, 39 and 43 were rejected as obvious over Hebsur '725 and '654. The Examiner admits that Hebsur '725 and '654 only teach **in situ** formation of alumina in a NiAl system and that Hebsur '725 does not teach formation of alumina during cryomilling[1]. The Examiner contends nevertheless that Hebsur '725 performs

[1] See page 9 of the Office Action in reference to claims 34, 35.

cryomilling in an oxygen atmosphere and that some **in situ** alumina might be inherently formed.

However, what is at issue is addition of a nanoparticle additive during cryomilling and not in situ formation. Hebsur '725 has been misunderstood. It is important to bear in mind that cryomilling is **by definition** conducted in liquid nitrogen. The total pick up of oxygen by the cryomilled material from impurities in the liquid nitrogen during a typical cryomilling run of NiCrAlY is about 0.10-0.15 weight percent. This trace amount of oxygen might form in-situ alumina, yttria or chromia.

In the claimed invention when we add the nano-alumina into the mix with the liquid nitrogen, we typically add the nano-alumina on the order of 2 weight percent. The distribution of the alumina within the cryomilled metallic alloy will clearly be different for these significantly different weight percentages.

It is important to keep in mind that the interface that results from an externally added particulate will also be significantly different than that for an in-situ formed oxide. No where in Hebsur '725 is alumina mentioned.

The Examiner notes Col. 3, lines 29-31, for the creation of non in situ alumina where it states:

> "**For purposes of comparison**, the cyclic oxidation of CoCrAlY under these conditions was also tested. The results are reported in FIG. 5. "

The reference to "comparison" together with what is shown in Fig. 5 clearly indicates that conventional material is being compared to their claimed NiAl-CoCrAlY system. The comparison is in the context of the claimed and conventional completely formed materials being tested against each other in an oxygen atmosphere and does not relate to the creation of alumina in an alloy system during original cryomilling of the material,

which will then be used in a subsequent step to create the coating on the substrate. The conventional CoCrAlY material listed in Fig. 5 would have been made with gas atomized powder, and then thermally sprayed. It would not have been cryomilled, because it was conventional and hence different than the claimed cryomilled NiAl-CoCrAlY system. Not surprisingly and consistent with the foregoing, Hebsur '725 in fact makes no reference to the cryomilling of CoCrAlY.

Hebsur '654 mentions **in-situ alumina** formation briefly in the background of the invention in Hebsur '654 (col. 2, lines 18-22) to extent that there might be trace amounts of oxygen in the liquid cryogen and in Table 1. The significance of this in-situ created alumina is **not** disclosed and does not play any part in the disclosure of the claimed invention later in the specification.

Both Hebsur '654 and '725 are directed only to an **in-situ AlN** formation, and it's role in the behavior or the performance of the coating and not to any role for alumina in the coating. Further, Hebsur '654 only teaches **in situ** formation of alumina in a material system consisting primarily of NiAl. Neither Hebsur '654 and '725 disclose any role for the **in-situ alumina** in a coating performance. Thus, there is no motivation, inference, leading or teaching from which a method or a product made by a method of providing a coating for enhance performance of the coating can be realized by addition on alumina which is **not in-situ**.

Each the claims 11, 12, 28, 34, 38, 39 and 43 include a limitation that the alumina is added during the cryomilling and thus is not comprised of only of in situ alumina that might be created in smaller amounts.

Claims 31 and 33 were rejected as obvious over Hebsur '725 in view of a new reference, Cybulsky US Patent 6,168,875. Cybulsky disclosed a MCrAlY protective coating 18 disposed between a substrate 12 and a bond coat 20 of Ir-Nb alloy. Hebsur teaches a NiAl/MCrAlY bond coat system.

Claim 31 differs from the other claims in that it claims a MCrAlY thermal barrier coating comprising a **first** bond coat on a substrate which already made of MCrAlY, and then a **second** nanostructured nano-composite bond coat with nanocrystalline size MCrAlY grains without inclusion of other metallic alloys on the first MCrAlY bond coat.

At most the combination of Cybulsky with Hebsur might suggest placing a second layer of MCrAlY between the NiAl/MCrAlY bond coat and the substrate. However, there is nothing to suggest that the second layer of MCrAlY must be a nanostructured nano-composite layer. Cybulsky is totally silent with respect to the crystalline structure or sizing of the second layer of MCrAlY and never mentions cryomilling in any context. Cybulsky's second layer is for protection of the substrate against oxidation and hot corrosion and has no connection with bonding. There is no leading whatsoever that this characteristic would be important for an intermediate bond coat or that the MCrAlY would need a nanostructured nano-composite second bond coat underneath it. Thus, the limitations of claim 31 is not suggested, motivated, taught or inferable from the combination of Hebsur and Cybulsky.

Claim 33 adds further limitations relating to how the nano-composite is structured or prepared and is allowable therewith.

Claims 34 and 35 were rejected as obvious over Hebsur '725 in view of Cybulsky.

The posed reasoning is not clear since Cybulsky is utterly silent with respect to alumina and aluminum nitride formation and does not disclose anything in regard to cryomilling. Further, it has been admitted by the Examiner that Hebsur '725 does not teach alumina formation during cryomilling. Therefore, the combination of Cybulsky and Hebsur '725 cannot logically teach anything about refining the microstructure of the MCrAlY powder to nanocrystalline grain size after cryomilling through the introduction of Al_2O_3 particles during cryomilling, which is the subject of claims 34 and 35. Whether or not in situ AlN is somehow formed in the bond coat of Hebsur '725 is further irrelevant to the claimed subject matter of claims 34 and 35 where alumina is added to the powder during cryomilling.

Claim 45 depends on claim 43 and is allowable therewith.

Applicant respectfully requests advancement of the claims to allowance or entry of the amendments as placing the claims in a better form for appeal.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on November 22, 2006 by

Signature

November 22, 2006

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